UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/885,871	06/20/2001	Masahiro Ooshima	9281-4138	3201

7590 05/11/2004

Michael E. Milz
Brinks Hofer Gilson & Lione
P.O. Box 10395
Chicago, IL 60610

EXAMINER	
WATKO, JULIE ANNE	
ART UNIT	**PAPER NUMBER**
2652	14

DATE MAILED: 05/11/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/885,871	Applicant(s) OOSHIMA ET AL.
	Examiner Julie Anne Watko	Art Unit 2652

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *12 April 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-3,5,6 and 8-19* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *1-3,5,6,9-11,18 and 19* is/are allowed.

6)☒ Claim(s) *12-17* is/are rejected.

7)☒ Claim(s) *8* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *20 June 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☒ Certified copies of the priority documents have been received in Application No. 09814531.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Priority

1. Receipt is acknowledged of papers (JP 2001-086261) submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file. A certified copy of an additional foreign priority document (JP 2000-085287) appears in the parent application (SN 09814531), but not in the instant application.

Claim Rejections - 35 USC § 103

2. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

3. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1-3, 5-6 9-11 and 18-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Carey et al (US Pat. No. 6266218 B1) in view of Saito et al (US Pat. No. 5972420) and Gill (US Pat. No. 6275363 B1).

As recited in claim 1, Carey et al show a spin-valve type thin film magnetic element (see Fig. 9, for example) comprising: a laminate comprising an antiferromagnetic layer 74, a pinned magnetic layer 76 in contact with an antiferromagnetic layer in which the magnetization

direction of the pinned magnetic layer is fixed by an exchange anisotropic magnetic field with the antiferromagnetic layer, and a non-magnetic conductive layer 80 formed between the pinned magnetic layer and a free magnetic layer 78; bias layers (92 in Fig. 9) for aligning the magnetization direction of the free magnetic layer in the direction substantially perpendicular to the magnetization direction of the pinned magnetic layer (see arrows in Fig. 9); ferromagnetic layers 90 formed in contact with the bias layers; and conductive layers ("electrical contacts", see col. 7, line 28) for applying a sensing current to the free magnetic layer, wherein each of the ferromagnetic layers is divided into two sub-layers separated by a first non-magnetic intermediate layer, the sub-layers being in a ferrimagnetic state in which the magnetization direction of one sub-layer is 180 degrees different from the magnetization direction of the other sub-layer (see antiparallel arrows of 84 and 86 in Fig. 9).

As recited in claim 1, Carey et al are silent regarding whether the bias layers 92 comprise at least one material selected from the group consisting of α-Fe_2O_3 and CoO.

As recited in claim 1, Saito et al shows bias layers 10 comprising α-Fe_2O_3 (see col. 5, lines 37-42).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use α-Fe_2O_3 as the bias layer of Carey et al as taught by Saito et al. The rationale is as follows: one of ordinary skill in the art would have been motivated to use α-Fe_2O_3 in order to avoid corrosion, to provide good adhesion, to increase a coercive force so as to stabilize the free magnetic layer and reduce Barkhausen noise, and to improve off-track performance by reducing an effect of a leaking magnetic field as taught by Saito et al (see col. 5, lines 37-64; see also col. 4, lines 29-39).

As recited in claim 1, Carey et al are further silent regarding whether the free magnetic layer is divided into two sub-layers separated by a second non-magnetic intermediate layer, the sub-layers being in a ferrimagnetic state in which the magnetization direction of one sub-layer is 180 degrees different from the magnetization direction of the other sub-layer.

As recited in claim 1, Gill '363 teach that it is advantageous when a free magnetic layer is divided into two sub-layers (210 and 212) separated by a second non-magnetic intermediate layer 208, the sub-layers being in a ferrimagnetic state in which the magnetization direction of one sub-layer is 180 degrees different from the magnetization direction of the other sub-layer (see col. 6, lines 12-29, "free layer 212 with a thickness of 60Å of nickel iron (NiFe) is considered sufficient in the art to promote optimized in-phase scattering of the conduction electrons conducted between the AP pinned structure 206 and the AP coupled free layer structure 202. The magnetization of this thickness, however, may be larger than the magnetization of the signal fields from a rotating magnetic disk. With the first AP free layer 210 having a thickness of 30Å of nickel iron (NiFe), for example the AP coupled free layer structure 202 has a net magnetization that is due to only 30Å of nickel iron (NiFe) which is the difference between the thicknesses of the first and second AP free layers 210 and 212. This enables the signal fields from the rotating magnetic disk to have less magnetization which, in turn, enables more magnetic bits to be impressed on the magnetic disk thereby increasing the linear bit density and storage capacity of a magnetic disk drive employed by the sensor.").

It would have been further obvious to one of ordinary skill in the art at the time the invention was made to use sub-layers and an intermediate layer for the free layer of Carey et al as taught by Gill '363. The rationale is as follows: one of ordinary skill in the art would have

been motivated to increase a data density and storage capacity by decreasing a magnetic moment of the free layer while maintaining a free layer thickness sufficient to promote optimized in-phase scattering of the conduction electrons as explicitly taught by Gill '363.

As recited in claim 2, Carey et al show that ferromagnetic layers 90 are disposed on the free magnetic layer with a distance corresponding to a track width (see Fig. 9), the bias layers being provided on the ferromagnetic layers ("AF layer 92 can At *(sic)* also be deposited on top of structure 90", see col. 9, lines 49-51) and the conductive layers being provided on the bias layers ("Electrical contacts 92 are typically made to top bias layer", see col. 7, lines 28-29).

As recited in claim 3, Carey et al show that the bias layers (92 in Fig. 9; see also col. 9, line 49, "AD layer 92") are provided at both sides in the track width direction of the laminate, the ferromagnetic layers 90 being provided on the bias layers, and the conductive layers being provided on the ferromagnetic layers 90 ("Electrical contacts 92 are typically made to top bias layer 84 on both sides of sensor 70", see col. 7, lines 28-29; although the electrical contacts are not explicitly shown in Fig. 9, their location on the ferromagnetic layers 90 is made apparent by 92 in Fig. 6).

As recited in claim 5, Carey et al show that the ferromagnetic layer comprises at least one element selected from the group consisting of Ni, Fe and Co ("Co, Fe, Ni or their alloys", see col. 5, line 43).

Regarding claim 6: Following the teaching for claim 1 above, the resulting structure necessarily satisfies claim 6 insofar as α-Fe_2O_3 contains Fe.

As recited in claim 9, Carey et al show that the bias layers 92 comprise an antiferromagnetic material ("AF layer 92", see col. 11, line 33).

As recited in claim 10, Carey et al show that the antiferromagnetic material 92 has a lower heat treatment temperature ("AF layer 92 is made of a low blocking temperature material with blocking temperature T1, and AF layer 74 is made of high blocking temperature material", see col. 11, lines 33-35) than that of the antiferromagnetic layer 74.

As recited in claim 11, Carey et al show that a free magnetic layer comprises a CoFeNi alloy ("Co, Fe, Ni or their alloys", see col. 5, line 43). As recited in claim 11, Carey et al also show Ru as a non-magnetic intermediate layer ("Suitable material choices include Ru", see col. 5, line 32).

As recited in claim 11, Carey et al are silent regarding whether the free magnetic layer comprises a first free magnetic layer and a second free magnetic layer which are separated by the second non-magnetic intermediate layer, the first free magnetic layer and the second free magnetic layer are in a ferrimagnetic state in which the magnetization direction of the first free magnetic layer is 180 degrees different from the magnetization direction of the second free magnetic layer).

See teachings, rationale and motivations for combining teachings above for claim 1.

As recited in claim 18, Carey et al show that the ferromagnetic layer 90 comprises a first ferromagnetic layer 86 and a second ferromagnetic layer 84 which are separated by a non-magnetic intermediate layer 88, the first ferromagnetic layer and the second ferromagnetic layer are in a ferrimagnetic state in which the magnetization direction of the first ferromagnetic layer is 180 degrees different from the magnetization direction of the second ferromagnetic layer (see arrows in Fig. 9), at least one of the first ferromagnetic layer and the second ferromagnetic layer comprise a CoFeNi alloy ("Co, Fe, Ni or their alloys", see col. 5, line 43), and the non-magnetic

intermediate layer 88 (see col. 7, lines 25-26, "non-magnetic exchange coupling layer 88", which performs the same function in the same way as exchange coupling layer 16 in Fig. 2A) comprises Ru ("Suitable material choices include Ru", see col. 5, lines 24-37, especially line 32).

As recited in claim 19, Carey et al show that both the first ferromagnetic layer 86 and the second ferromagnetic layer 84 (wherein 86 and 84 perform the same function in the same way as 12 and 14) comprise the CoFeNi alloy ("top and bottom bias layer 12, 14 are made of a magnetic material such as Co, Fe, Ni or their alloys", see col. 5, line 41)***Allowable Subject Matter***

4. Claims 12-17 are allowed.

5. Claim 8 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Response to Arguments

6. Applicant's arguments filed April 12, 2004, have been fully considered but they are not fully persuasive.

Applicant's arguments with respect to Mack et al (US Pat. No. 6462919) are moot insofar as the rejections including Mack et al are not maintained.

Applicant's arguments with respect to Carrey et al (US Pat. No. 6266218 B1) are not persuasive. On page 11, 3rd paragraph, Applicant states that:

> The pending claim 1 recites that the spin valve type thin film magnetic element comprises bias layers for aligning the magnetization direction of the free magnetic layer in the direction substantially perpendicular to the magnetization direction of the pinned magnetic layer, ferromagnetic layers formed in contact with the bias layers, and conductive layers for applying a sensing current to the free magnetic layer. This claim 1 structure is not disclosed or suggested by Carrey. In Carrey, the anti-parallel longitudinal bias structure 90 is in fact composed of bias layers 84, 86 which are separated by a non-magnetic exchange-coupling layer 88. As

> such, Carrey's bias structure 90 is analogous to Applicants ferromagnetic layers 7, wherein each of the ferromagnetic layers 7 is divided into two sub-layers separated by a first non-magnetic intermediate layer, with the sub-layers being in a ferrimagnetic state in which the magnetization direction of one sub-layer is 180 degrees different from the magnetization direction of the other sub-layer. However, Carrey do not suggest or teach an additional bias layer, such as Applicant's bias layer 6, being in contact with the bias structure 90.

The Examiner has considered this argument thoroughly and asserts that Fig. 9 of Carey et al shows bias layer 92 in contact with bias structure 90. Because Carey et al explicitly show the claimed bias layer structure, it is unnecessary to rely on Gill for the claimed bias layer structure.

Furthermore, the use of the claimed material for the bias layer is explicitly taught by Saito et al (US Pat. No. 5972420).

Conclusion

7. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, THIS ACTION IS MADE FINAL. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

8. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Julie Anne Watko whose telephone number is (703) 305-7742. The examiner can normally be reached on Sat & Mon until 9PM, Wed & Fri until 5PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Hoa T. Nguyen can be reached on (703) 305-9687. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Julie Anne Watko
Primary Examiner
Art Unit 2652

May 8, 2004
JAW